

Attempt all questions:

1. Discuss the term "CAD"; focusing on the following points:
  - Applications of CAD in the field of computer engineering.
  - Steps of the development process for CAD software.
2. For the basic Electrical Circuits:
  - a. Design an analysis algorithm using the graphical representation.
  - b. Apply the designed algorithm on a simple example
3. Draw a Petri Net model for describing the dynamic behavior of the computer system shown in (Fig.1).  
Each (Computer-1/ Computer-2) will be in one of the following states:
  - a) Runs (Report-1/Report-2) internally.
  - b) Requests to print (Report-1/Report-2) in a common Printer
  - c) Uses the Printer.

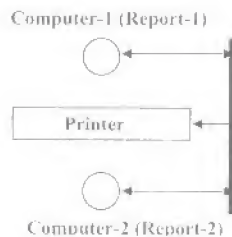


Figure 1: Computer System

4. Design suitable Data Structures for the Petri Net model and use the designed data structure to represent the Petri net model of question 3
5. For the computer system of problem 2; assume that we have **3 computers and 2 printers**; suggest a modification to the syntax of the Petri Net model to be suitable for describing the dynamic behavior of such a system. Draw the Petri Net model that describes the dynamic behavior of the new system.

Course Title: Elective Course (1) (PLC)  
Date: 24/06/2010 (second term)Course Code:  
Allowed time: 3 hrsYear: 3<sup>rd</sup>  
No. of Pages: (2)**Remarks:** (answer the following questions)**Problem number (1) ( Marks)**

1. Plane a ladder program for the following instruction list programs:

(1)  
LD %I0.0  
AND %M1  
OR %I0.2  
ST %Q0.0

(2)  
LD %I0.0  
AND( %M1  
OR %I0.2  
)  
ST %Q0.0

(3)  
LD %I0.0  
AND( %I0.1  
AND %M4  
OR(N %M5  
AND %I0.2  
)  
)  
ST %Q0.3

**Problem number (2) ( Marks)**

Design a PLC control system to control a Traffic Sign Lights such that it changes automatically with the following sequence:

Green light for 15 sec, Green and Yellow lights for 4sec, Red light for 12 sec, and Red and Yellow lights for 3 sec.

**Problem number (3) ( Marks)**

- a) Write a simple PLC program to test and verify the operation of the up/down counter?
- b) Write a simple PLC program to test and verify the operation of the three different types of timers
- c) Design a PLC control system to control a garage such that the garage has two gates one for car entry and the other for car going out, the garage capacity is 10 cars



Answer all Questions:

- 1- (a) What are the interrupt sources?  
(b) Write a program to initialize PORTA?  
(c) Write a program for reading data from EEPROM?

2- Define:

- (i) Prescaler,
- (ii) GPR,
- (iii) SFR,
- (iv) FSR,
- (v) INDF.

- 3- (a) The..... register contains the various enable bits for all interrupt sources.  
(b) Program memory in PIC 16F84 is ..... Bits.  
(c) In PIC 16F84, locations from ..... to ..... are reserved for *SFR* registers.  
(d) In PIC 16F84, *PORTA* has ..... bi-directional bits wide, and the corresponding register for data direction is .....  
(e) If *W* register contains *0x20* and *FSR* register contains address *0xC2* and the address location *0xC2* contains *0x00*. After executing the instruction *movwf INDF*, *W* contains....., *FSR* contains....., and address location *0xC2* contains.....  
(f) Register ..... holds the reading data from EEPROM, or that to be written to EEPROM.

4- (a) Explain the following program:

```
loop      movlw 0x0C  
          movwf FSR  
          clrf  INDF  
          incf  FSR  
          btfss FSR,4  
          goto LOOP
```

CONTINUE

P.T.O.

(b) Correct the following program and rewrite it;

```

movlw 0xFF      ; set w = 255 decimal
movwf COUNT

COUNT equ 03h

bcf STATUS,5
movlw 0x00      : Switch to Bank 1
movwf TRISA
bsf STATUS,5    : Switch to Bank 0

Start    movlw 0x02      Write 02h to the W register.
         movwf PORTA     Now move the contents of W (02h)
         movlw 0x00
         movwf PORTA

Loop     decfsz COUNT,2
         goto Loop1
         goto Start

```

- 5- Write a program to get a LED connected to PORTA flashing with equal time in ON and OFF.



### Answer The Following Questions

#### The First Question

State whether each of the following statements is true or false.

1. SQL is based on relational tuple calculus.
2. SQL is a "nonprocedural" or "declarative" language.
3. Application portability means applications can be moved from machine to machine when each machine uses SQL.
4. DDL commands are used to define a database, including creating, altering, and dropping tables and establishing constraints.
5. DML commands are used to maintain and query a database, including updating, inserting, modifying, and querying data.
6. DCL commands are used to control a database including administering privileges and saving of data.
7. To see the description of the table we have created we have the command DESC.
8. Selection operation can be considered as row wise filtering.
9. The projection operation performs column wise filtering.
10. The COUNT (DISTINCT attribute name) command returns the number of rows of the relation, by eliminating duplicate values.
11. The GROUP BY clause is used to group rows to compute group-statistics.
12. The HAVING restricts the groups according to a specified condition.
13. Whenever an attribute is declared as NOT NULL, then it specifies that the attribute cannot contain a NULL value.
14. The UNIQUE constraint specifies that whenever an attribute or set of attributes are specified as UNIQUE, then the values of the attribute should be unique for all the rows of the table. For example, consider the Roll number of the student in the class, every student should have UNIQUE roll number.
15. PRIMARY KEY constraint is used to identify each row of the table uniquely.
16. FOREIGN KEY constraint specifies that the value of an attribute in one table depends on the value of the same attribute in another table.
17. CHECK constraint defines a condition that each row must satisfy. Also there is no limit to the number of CHECK constraints that can be imposed on a column.
18. The UNION command removes duplicate values.
19. The intersection operation returns the tuples that are common to the two relations.
20. Atomicity is attained by undoing the actions of transactions that do not commit.
21. Durability is attained by making sure that all actions of committed transactions survive system crashes.
22. The types of anomalies that may occur on a relation that has redundant data are Insertion, Deletion, and Update anomalies.
23. The purpose of normalization is to put data into the form that is more able to accurately accommodate change.
24. Transaction is the execution of user program in DBMS.
25. ACID is an acronym for Atomicity, Consistency, Isolation, and Durability.
26. Deadlock is the lock that occurs within the Transactions in DBMS system.
27. Deadlock occurs mainly due to the Lock Based Concurrency Control.
28. If the Transaction is interrupted in the middle way it leaves the database in the inconsistency state.
29. Interleaved Execution is the switching over of execution between the Transactions.
30. Deadlock avoidance means that A transaction must obtain all its locks before it can begin so deadlock will never occur.

#### The Second Question

(a) Give SQL statements that are required to:

1. Specify a fixed-point number.
2. View the entire table.
3. Deleting Row from the Table
4. Modifying the column of the Table.
5. Deleting the column of the Table.

(b) Consider two relation **DEPARTMENT** and **EMPLOYEE** as shown in Fig. 1 and Fig. 2. Here the **DEPARTMENT** relation forms the parent table, which contains the primary key **DeptID**. The relation **EMPLOYEE** forms the child table that has foreign key **DID** which references to primary key in **DEPARTMENT** table.

If the clause **ON DELETE CASCADE** is included in the child table Give the syntax for SQL command and the corresponding output in the following cases:

- 1- Declare the relations **DEPARTMENT** and **EMPLOYEE**.
- 2- delete the department "Civil" in the **DEPARTMENT** table

DEPARTMENT			EMPLOYEE		
DeptID	Division	Location	ETO	DDO	Enname
D100	electrical	B	E201	D100	Ramou
D101	civil	A	E202	D101	Ravi
D102	computer	C	E203	D101	Krishnan

Fig 1. DEPARTMENT

Fig 2. EMPLOYEE

### The Third Question

- (a) Explain why the table given below is not in first normal form.

Department number	Department name	Location
1	Virgins	{Cumbalore, Chennai}
2	Satishde	{Chennai, Tirunelveli}
3	Krishna	Trichy
4	Kauman	Cuddalore

- (b) A company obtains parts from a number of suppliers. Each supplier is located in one city. A city can have more than one supplier located there and each city has a status code associated with it. Each supplier may provide many parts. The company creates a simple relational table to store this information.

FIRST (sf, status, city, pf, qty)  
 sf: Supplier identification number  
 status: Status code assigned to city  
 City: City where supplier is located  
 pf: Part number of part supplied  
 Qty: Qty of parts supplied to date  
 Composite primary key is (sf, pf)

Identify in which normal form the table FIRST belongs to and normalize it to third normal form?

FIRST				
sf	city	status	pf	qty
s1	Chennai	20	p1	300
s1	Chennai	20	p2	100
s1	Chennai	20	p3	200
s1	Chennai	20	p4	100
s2	Delhi	10	p1	250
s2	Delhi	10	p3	100
s3	Mumbai	30	p2	300
s3	Mumbai	30	p4	200

### The Fourth Question

- (a) Consider a database with objects X and Y and assume that there are two transactions T1 and T2. Transaction T2 reads objects X and Y and then writes object X. Transaction T1 reads objects X and Y and then writes objects X and Y.

- 1- Give an example schedule with actions of transactions T1 and T2 on objects X and Y that results in a write-read conflict.
- 2- Give an example schedule with actions of transactions T1 and T2 on objects X and Y that results in a read-write conflict.
- 3- Give an example schedule with actions of transactions T1 and T2 on objects X and Y that results in a write-write conflict.
- 4- For each of the three schedules, show that Strict 2PL disallows the schedule.

- (b) Find out whether the following system is in Deadlock or not?

Total Number of Processes 4 (P1, P2, P3, P4)  
 Total Number of Resources 4 (R1, R2, R3, P4)  
 P1 holds R1 and waiting for R2.  
 P2 holds R2 and waiting for R3  
 P3 holds R3 and waiting for R4.  
 P4 holds nothing and waiting for R4.

*With my best wishes*

Work out the following questions.

### Question 1 (10 marks)

Copy the following table in your answer sheet and fill it by the answers of the question items

Item	a	b	c	d	e
Part1: (True/false)					
Part 2: (i/ii/iii/iv)					

- Determine whether each of the following statements is true or false
  - In any strongly connected event diagram component of nodes that has no incoming arcs from other event nodes outside the component, there must be at least one node that is initially scheduled.
  - In the simulation library you studied, the function call `filest(2)` provides summary data on the number of records stored in the list 2 during the simulation
  - In the simulation library you studied, the function call `sampst(20,2)` register the value 20 as a sample of the discrete-samples variable number 2
  - The verification of a discrete-event simulation model is the process of debugging the simulation program
  - In practice, it's common to have a single universal system model rather than several models each developed to serve a certain objective.
- Select the best continuation for each of the following statements from the given alternatives
  - During the execution of an event routine in discrete-event simulation
    - The execution time passes but not the simulated time
    - The simulated time passes but not the execution time
    - Both the execution time and the simulated time pass
    - Neither the simulated time nor the execution time passes
  - When using the next-event time-advance approach in building a discrete-event simulation model: after the execution of an event-routine, the time is advanced
    - By a fixed interval  $\Delta t$  that depends on the system dynamics
    - To the time of the first event in the event list
    - To the time of the last event in the event list
    - To the time of the event that has the smallest time among all events in the event list
  - In discrete-event simulation models, an event has two attributes: event time and event type. Event type is used to
    - Determine the type of the event
    - Determine the data type of the state variable that led to the event invocation
    - Select the event routine corresponding to the event
  - A discrete event simulation model is valid if



- 
- i. The system conceptual model is an accurate representation of the real system
  - ii. The system conceptual model is accurately translated to a simulation computer program
  - iii. The model is credible from the stake holder's point of view
- e. A strongly connected component in an event diagram for a discrete- event simulation model
- i. Must contains at least one node that is initially scheduled
  - ii. Must contains at least one node that is initially scheduled if it has no incoming arcs from other event nodes outside the component
  - iii. Must contains at least one node that is initially scheduled if it has no outgoing arcs to other event nodes outside the component

### Question 2(20 marks)

A company that sells a single product would like to decide how many items it should have in inventory for each of the next  $n$  months. The times between demands are independent and identically distributed (IID) exponential random variables with a mean of 0.1 month. The sizes of the demands,  $D$ , are IID random variables (independent of when the demand occurs), with:

$$D = \begin{cases} 1 & \text{with probability } \frac{1}{6} \\ 2 & \text{with probability } \frac{1}{3} \\ 3 & \text{with probability } \frac{1}{3} \\ 4 & \text{with probability } \frac{1}{6} \end{cases}$$

At the beginning of each month, the company reviews the inventory level and decides how many items to order from its supplier. An order costs the company  $32 + 3 \cdot Z$  LE, where  $z$  is the number of items to order. When an order is placed, the time required for it to arrive is a random variable that is distributed uniformly between 0.5 and 1 month. The company uses a stationary  $(s, S)$  policy to decide how much to order, i.e.,

$$Z = \begin{cases} S - I & \text{if } I < s \\ 0 & \text{if } I \geq s \end{cases}$$

where  $I$  is the inventory level at the beginning of each month

When a demand occurs, it's satisfied immediately if the inventory level is at least large as the demand. If the demand exceeds the inventory level, the excess of demand over supply is backlogged and satisfied by future deliveries. When an order arrives, it's first used to eliminate as much of the backlog (if any) as possible; the remainder of the order (if any) is added to the inventory. The holding cost is 1 LE per item per month. The company also assumes a backlog cost of 5 LE per item per month.



Assume that the initial inventory level is  $I(0)=60$  and no order is outstanding. It's required to simulate the system for  $n=120$  months and using the average total cost to compare the following inventory policies:

s	20	20	20	20	40	40	40	60	60
S	40	60	80	100	60	80	100	80	100

- Show how the total per month average cost can be calculated
- Draw the event diagram
- Show how the demand size random number generators can be build from a uniformly distributed random number generator  $U(0, 1)$
- Describe your simulation program using flowcharts

### Question 3( 15 marks)

- List the general steps that should be done in a sound simulation study
- Mention some techniques that could be used in the verification of a simulation model
- Give the main differences between General-purpose and application oriented simulation packages

### Question 4(20 marks)

A service facility consists of two servers in series (tandem), each with its own FIFO queue (see Figure below). A customer completing service at server 1 proceeds to server 2, while a customer completing service at server 2 leaves the facility. Assume that the inter-arrival times of customers to serve 1 are Independent and Identically Distributed (IID) exponential random variables with mean =1 minute. Service times of customers at server 1 are IID exponential random variables with mean 0.7 minute, and at server 2 are IID exponential random variables with mean 0.9 minute. It's required to estimate for each server the expected average delay in queue of customer, the expected time average number of customers in queue, and the expected utilization.

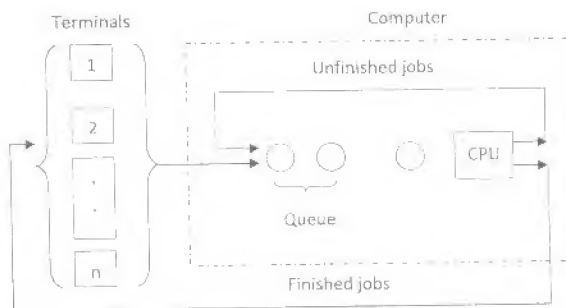


- Draw event diagram for the simulation
- Draw and comment the flowcharts for the simulation timing and all event routines considering that it's required to simulate the facility for exactly 1000 minutes.
- How the flowcharts will be modified if the system is simulated until 1000 customers completed their delays in customer queue at server 2?
- How can the expected average total delay in queue be calculated from the expected average delays in queues at the two the servers in part 3? Explain your answer.

### Question 5(20 marks)

A company has a computer system consisting of a single central processing unit (CPU) and  $n$  terminals, as shown in the figure below. The operator at each terminal thinks for an amount of time that is an exponential random variable with mean 25 seconds, and then sends to the CPU a job having a service time distributed exponentially with mean 0.8 second. Arriving jobs join a single queue for the CPU and are served in a round-robin with service quantum of length 0.1 second and swap time of 0.015 second. A job returns immediately to its terminal when it is finished being processed. At that instant, the processor fetches another waiting job (if any), even if the service quantum not yet finished, and the operator at that terminal begins thinking to send a new job. The response time  $R_i$  of the  $i^{\text{th}}$  job to finish service is defined as the time elapsing between the instant the job leaves its terminal and the instant it is finished being served. Assume that all terminals are in the think state at time 0. It is required to simulate the system for the cases  $n=10, 20, \dots, 80$  for 1000 job completion in each case.

- Suggest other performance measures (other than  $R_i$ ) that could be used to evaluate the system
- Specify the state variable you will use to describe the system
- Draw the event diagram for your simulation
- Explain your simulation using the necessary flowcharts
- Using any programming language of your choice, write down the simulation program. You can assume the existence of a library code like the simulation library "SimLib".



Best wishes

Course Title: Digital Control Systems  
Date: June 20<sup>th</sup> 2010Course Code: CCE3220  
Allowed time: 3 hrsYear: 3<sup>rd</sup>  
No. of Pages: (2)

**Remarks:** You must show all of your work -- partial credit may be given to partially correct answers, while answers with no justification may not receive full points. Attempt all questions. Each problem answers should be separated from others.

**Problem (1) (17 Marks)**

- Explain briefly with aid of drawings the conditions to be satisfied for reconstruction of sampled signal into continuous signal.
- Derive the transfer function of Zero Order Hold (ZOH) device.
- Explain briefly the concepts of controllability and observability of discrete time control system.
- Obtain the z-transform of the function  $x(t)$  shown in Fig.(1). Assume  $T=1$  sec.
- Check using bilinear transformation the stability of the control system having the characteristic equation:-

$$Z^3 + 5Z^2 + 3Z + 2 = 0$$

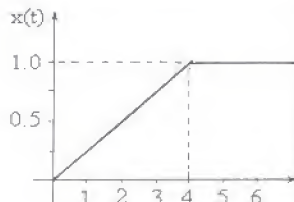


Fig.(1) of problem 1-d

**Problem (2) (14 Marks)**

- Find using Root Locus technique the stable range of  $K$  for the system shown in Fig.(2). Given  $T = 0.4$  sec
- Repeat part (a) using jury test of stability.

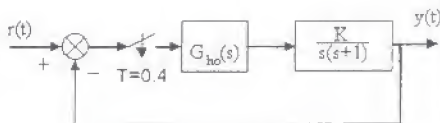


Fig.(2) of problem 2

**Problem (3) (12 Marks)**

The open loop transfer function of a unity feedback digital control system is given by:-

$$G_{ho}G_p(z) = \frac{0.0453(z + 0.904)}{(z - 0.905)(z - 0.819)}, \quad T=0.1 \text{ sec}$$

- Find the steady state error of the system when the input is unit step
- Determine the final value of the output for a unit step input
- Find the first four terms of the response -  $y(0)$ ,  $y(1)$ ,  $y(2)$ , and  $y(3)$  - due to a unit step input

**Problem (4) (12 Marks)**

- Given the Matlab program

```
s1 = 0; e = 0;
for k=0:5
    s2 = e - s1;
    m = 0.5*s2 - s1;
    s1 = s2;
    [k,m]
    e = e + 1;
end
```

- Find the transfer function of the controller.
- Find the Z-transform of the controller input and controller output

- For the block diagram given in Fig.(3) find, if it exists, the closed loop transfer function.

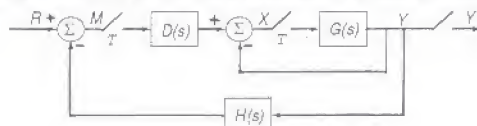


Fig.(3) of problem 4-b

P.T.O.

**Problem (5)****(16 Marks)**

a) For the discrete-data system given by the state equations

$$\mathbf{x}(k+1) = \begin{bmatrix} 1.35 & 0.55 \\ -0.45 & 0.35 \end{bmatrix} \mathbf{x}(k) + \begin{bmatrix} 0.5 \\ 0.5 \end{bmatrix} u(k)$$

$$y(k) = [1 \ 0] \mathbf{x}(k)$$

- i. Find the system transfer function
- ii. Check the system stability

b) Obtain two different state space representations in canonical form of the discrete-data dynamic system described by the difference equation :- (use state diagrams)

$$y(k+2) - y(k+1) + 0.16 y(k) = u(k+1) + 2 u(k)$$

subject to zero initial conditions.

**Problem (6)****(19 Marks)**

Consider the state space model of a servo motor with a sampling period  $T=0.1$  sec

$$\mathbf{x}(k+1) = \begin{bmatrix} 1 & 0.0952 \\ 0 & 0.905 \end{bmatrix} \mathbf{x}(k) + \begin{bmatrix} 0.00484 \\ 0.0952 \end{bmatrix} u(k)$$

$$y(k) = [1 \ 0] \mathbf{x}(k)$$

- a) Check the system controllability and observability.
- b) Determine the gain matrix  $K$  such that the desired closed loop poles located at  $Z_{1,2} = 0.888 \pm j 0.173$
- c) Design a full state observer such that the time constant of the observer poles is one half the time constant of the desired closed loop poles in part (b). Choose the observer poles to be real and equal.
- d) Write the observer state dynamic equation.

Good Luck

Dr. Ahmed A. Ramadan

Course Title: Software Engineering  
Date: June 13<sup>th</sup> 2010 (Second term)Course Code: CCE 3218  
Allowed time: 3 hrsYear: 3<sup>rd</sup>  
No. of Pages: (2)

**Remarks: Please Read the question more than once to fully understand it before you start solving. Do not forget to make verification and validation for your answers.**

**Problem number (1) (25 Marks)**

(a) If you are hired to work as a SW maintenance engineer at one of the leading companies (In Sha'a Allah), answer the following questions please and put them in an organized way to be easily read:

- 1- What are the task(s) you will have to do at your new job (i.e. your job description).
- 2- What skills should you have to be a good worker at this job?
- 3- What difficulties (الصعوبات التي ستواجهها) will you face during this job and how will you solve them?
- 4- What is the importance of your job to the SW usage period?

(b) For each of the following problems, find the best possible solution. Also, determine who is responsible to apply the solution found and when is the suitable time to solve each problem.

- 1- Some resources needed for the project are subjected to be delayed (معرضة للتأخير) as they will be brought from outside the country.
- 2- The users of the SW being developed are hesitating (مترددین) and do not know what to require in the SW and some of them have contradicting (آراء متعارضة) opinions.
- 3- The SW system delivered to the company is not working under the newly bought hardware platform.

**Problem number (2) (20 Marks)**

(a) In a SW designed for a car rental shop (محل تأجير سيارات) there are many tasks required. They need to add, delete and update car's data, make car rental for a car which will include storing the customer data and the beginning date of the rental, and to search for a specific type of cars in the shop.

- 1- Determine the processes to be found in level-0 DFD.
- 2- Determine the sources/sinks available.
- 3- Determine the datastores required.
- 4- Draw level-0 DFD.
- 5- Draw context diagram and balance it with level-0.
- 6- Make a suggestions for the database required for such system.

(b) Compare between the following pairs:

- 1- Incremental and spiral SDLC.
- 2- Static and dynamic test techniques.

**Problem number (3) (15 Marks)**

(a) What is the origin of the following SW, and make a small note on each:

- 1- Printer driver
- 2- SQL server SW
- 3- Toshiba company Web page

- (b) Connect sentence part from column A to its second part in column B and write the complete sentence into your papers. Then choose two of the produced sentences to discuss in some details:

Column A	Column B
DFD is used in	The appropriate programming language
Implementation requires the choice of	Identifying them and put a plane for them
Risk assessment means	Verbs only
Process names should begin with	Design phase

Problem number (4) (20 Marks)

- (a) Fill in the spaces for each statement. Write down the whole statement into your papers:

- 1- Pert chart shows ----- (draw an example for it too)
- 2- Political feasibility is interested in determining ----- according to -----.
- 3- You have to prepare a plane for an interview that contains -----

- (b) Suggest at least three functions to be required in Realplayer (مشغل فيديو ونغمات) SW developed for a company. Draw the conceptual model and write the description of each function in a clear way. Also, add two non-functional requirements that could be required.

Good Luck all